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CREATION OF POLYMER BITUMEN COMPOSITION FOR ROOFING BASED ON LOCAL RAW MATERIALS

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ABSTRACT

In this article, the use of polymers, the most promising direction in the modification of bitumen for modern roof coverings, has been effectively studied. In the article, the physical and chemical properties of bitumen and the polymer used in the experiment have been analyzed. Based on local raw materials, a polymer bitumen composition was created for roofing materials, and its properties were analyzed and evaluated. in the work, the author focused on the advantages and disadvantages of using the created composite material as a roof covering, using electronic and written sources in the experiment, as well as the results of a small research conducted at the Neftgaz and Kimyo Mashinazakot Zavodi JSC enterprise.

***Keywords**: Bitumen, polymer, roofing, water resistance, temperature resistance, polymer bitumen composition, local raw materials, HDPE, ECO.*

АННОТАЦИЯ

В данной статье эффективно изучено использование полимеров, наиболее перспективного направления модификации битумов для современных кровельных покрытий. В статье проанализированы физико-химические свойства битума и полимера, использованных в эксперименте. На основе местного сырья создана полимерно-битумная композиция для кровельных материалов, проведен анализ и оценка ее свойств. в работе автор акцентировал внимание на преимуществах и недостатках использования созданного композиционного материала в качестве кровельного покрытия, используя в эксперименте электронные и письменные источники, а также результаты небольшого исследования, проведенного в АО «Нефтегаз и Кимё Машиназакот Заводи». предприятие.

***Ключевые слова:** Битум, полимер, кровля, водостойкость, термостойкость, полимербитумная композиция, местное сырье, ПНД, ЭКО.*

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INTRODUCTION

It is known that today the system of construction objects is becoming more complex, the aggravation of climate change, the creation of durable, economical, environmentally friendly and technological roofing and waterproofing coatings remains one of the most important tasks in the construction industry. Currently, energy-intensive and ecologically imperfect "hot" technology is used for the production of rolled roofing and waterproofing materials. As an alternative way of obtaining these materials based on bitumen emulsions, the use of "cold" technology is currently being used. Petroleum bitumen - the largest petrochemical product - is the main component of waterproofing and roofing materials, and is now widely used in construction.

However, the increasing requirements for performance and durability of bitumen-based materials require their modification. The main disadvantages of bitumen are intensive atmospheric aging and a narrow temperature range of deformation due to its chemical nature and characteristics of a dispersed structure.

Every experienced builder knows that moisture has a negative effect on the properties of structural elements and the integrity of structures, reducing their durability and reliability. At any stage of construction, from the foundation to the roof, it is recommended to use professional waterproofing materials to reduce water exposure and extend the life of buildings. Each specific option is selected from its operating conditions. That being said, even with all the complexity, the two essential waterproofing solutions are very simple and require the right skills, knowledge and understanding of the issue.

Purpose of work:development of bitumen-polymer emulsions using a mixture of anionic surfactants obtained from industrial waste for the production of effective roll roofing and waterproofing materials using "cold" technology.

LITERATURE ANALYSIS FROM TOPIC SURFACE

Oil bitumen is one of the large tonnage oil products and at the same time it is one of the rare products. The share of bitumen production from the total amount of processed oil is 2.6%. Undoubtedly, the reason for this is that bitumen has not been considered as a target-oriented product for a long time and due attention has not been paid to the improvement of its production technology, and the reason for this is that bitumen quality and its volume do not meet the requirements of the relevant industry. Today, the demand for it in a number of sectors is increasing year by year. If we

assume that the total need for bitumen is 80%, the need for road bitumen is 60%, and in particular, it is 10-11% in the production of roof coverings.

It is known that the main method of processing residual oil distillates to obtain bitumen is oxidation with air oxygen, the essence of which is to increase the viscosity of the oil product due to the reactions of decarboxylation, dehydrogenation, polycondensation, etc., which occur at high temperatures (220-300°C).

Improving the design of oxidizers and optimizing the oxidation process is not the only way to activate bitumen production. The problem of bitumen shortage can be solved by expanding non-traditional raw material resources and improving the quality of raw materials for bitumen plants, for example, by using the activating effect of energy fields (magnetic, electromagnetic, ultrasonic, etc.). .)

- Bituminous composition - 50% bitumen solution in xylene or toluene according to GOST 22245, BND 60/90 level.
- The polymer composition is a solution of 20I (TU 6-55-9-90) chlorosulfonated polyethylene in toluene or xylene, or HP 743 lacquer with filler and vulcanizer.

Composition and application: We know that each polymer-based compound has its own characteristics, such as high water resistance, adhesion strength and weather resistance. The most popular types of polymer-based compounds are:

- Butyl rubber
- Nitrile rubber
- Styrene-ethylene propylene diene monomer (SBR)
- Polyvinyl acetate (PVAc)
- Epichlorohydrin (EKO)
- Ethylene acrylate copolymers (EAM)
- The most commonly used bitumen include recycled SBS modified with butyl acrylate, ABS with ECO and bitumen with SBR.

PMBS is one of the best roofing materials because it is stronger, lighter, and easier to handle. Roofing materials are very durable, which saves on maintenance costs.

The process of polymer modification can be done by mixing the emulsion with the polymer. When the mixture is dry, the coating is produced by a hot press machine, which melts the metal layer with a thin layer of bitumen, and then covers it with two layers of reinforcement.

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Additional reinforcement on both sides prevents damage from impact from obstacles, construction equipment or accidents. In addition, when the air temperature drops and freezes, these covers make it easier to transport, they adapt to temperature changes.

METHODOLOGY

The components of the polymer-bitumen composition are delivered separately in metal drums or flasks according to GOST 5799. Preparation of the composition should be carried out in an open area or in an intensively ventilated room at a temperature not lower than +5 °C.

Preparation of the composition is carried out by mixing polymer and bitumen components in a ratio of 3.5: 1 in a container whose volume is determined by the variable consumption of the material. Mixing time is 10-15 minutes. In this case, the viscosity of the finished composition should not exceed 40 seconds according to the B34 viscometer. After mixing, the composition is kept for one hour. The period of time to become a ready composition is 24 hours (in closed containers).

RESULT AND DISCUSSION

The simplest mechanism for mixing components can be any type of electric drill, with a rotation speed of up to 300 rpm, equipped with a blade nozzle. Concrete mixers BSP-150 M "Tornado" with a mixing mass of 150 liters can be used as mixers.

To ensure the desired quality of the prepared mixture, the following conditions must be observed:

- The accuracy of the dosage of components during mixing should not exceed + 3% of the mass of the mixture;

- Thorough mixing of the mixture should ensure a homogeneous jelly-like consistency as a result of a sequence of three stages of the mixture state: initial mixed liquid, formation of numerous jelly-like clots, and transformation. It turns into a homogeneous jelly-like mass.

Bitumen-polymer mastic must be produced in accordance with the requirements of technical regulations and technological regulations according to the approved recipe.

To solve the problem of combining polyethylene with bitumen, it was melted together with a polyethylene film made of low-pressure polyethylene (HDPE) and served as a container at a temperature of 120 ± 10 ºC in a metal container without stirring. The weight of low-pressure polyethylene was 5% of the weight of bitumen. The resulting mixture was then cooled to ambient temperature. Visually, it was

determined that the mixture was layered. The highest amount of polyethylene was in the upper layer of the mixture, and the lowest amount was in the lower layer. The study of samples taken from different layers was carried out in the laboratories of the oil refinery according to standard methods. The results of laboratory studies of the properties of bitumen with the addition of 5% by weight of low density polyethylene are presented in Table 1

Table 1

Properties of low-density polyethylene bitumen BN 90/10 without fillers

Indicators	original bitumen	bottom layer melting	Upper layer melting	in the middle melting	Requirements GOST 6617-76
Softening temperature, ºC	88.7	90.17	93.2	95	Not less than 90
Penetration, mm, at 25 ºC	10.01	7.7	5.9	6	5...20
Water soluble compounds composition, % wt.	2.46	4.5	5.2	-	should not exceed 0.3
Water content, weight %.	0.04	No	No	-	Not included
Solubility in benzene, CHCl3, % by weight.	98.62	98.47	95.73	-	At least 99
Elongation at 25 ºC	four	-		3.2	At least 1
Flash point, ºC	270	-		294	Not less than 240

table 2

Properties of BN 90/10 bitumen with filled low pressure polyethylene

Indicators	original bitumen	Bitumen + 1% HDPE	Bitumen + 3% HDPE	Bitumen + 5% HDPE
Softening temperature, ºC	90.9	96	98	107.5
Penetration at 25 ºC × 0.1	12.84	11.55	10.8	8.2

mm				
Flash point, ºC	**290**	**295**	**291**	**290**
Fragility temperature, ºC	**- four**	**- 2**	-1	**4.5**

The analysis of the obtained results shows that with an increase in the amount of polymer in the mixture layer, the softening temperature of bitumen increases, penetration, solubility in benzene, and the ability to stretch decrease. These results indicate that polyethylene is inert to bitumen, and the effect of polyolefins on bituminous materials is a physical rather than a chemical phenomenon. It can be seen that the polymer swollen in bitumen forms a spatial structure in the bitumen mass, which determines the properties of the composition. Therefore, in order for the polymer to spread evenly in the bitumen, they must be thoroughly mixed.

In order to determine the dependence of bitumen's softening point, penetration, solubility, brittleness temperature, and elongation on the amount of polyethylene, the mixture was homogenized in a reactor with a stirrer at a temperature of 200 ± 5 ºC (for 30 minutes). Polyethylene is included in bitumen in the amount of 1, 3, 5, 8% bitumen.

Bitumen selected as a research object was analyzed by standard methods. The following relationships are established: An increase in the amount of polyethylene leads to an increase in the softening temperature.

With an increase in the polymer content, the steel needle's resistance to immersion in water increases and

The least effect is achieved with the addition of 1 to 3% of polymer by weight of bitumen

Addition of polyolefin in amounts ≤1% helps to reduce the embrittlement temperature, more than 1% - the embrittlement temperature increases

The solubility of bitumen in benzene or chloroform decreases sharply with the addition. Analysis shows that bitumen is satisfied with 1% polyolefin-containing material. In addition, this composition has a higher plasticity range than the original bitumen. With a high polymer content, the mixture is usually not homogeneous and the bitumen properties deteriorate.

Thus, according to the results of the study of the properties of polymer-bitumen composites and the creation of polymer-bitumen composite materials for roof coverings, the most effective effect is achieved with the addition of polyolefins in the

amount of about 1% of the bitumen mass, provided that the mixture is thoroughly mixed.

CONCLUSION

1) Bituminous materials wear out the fastest as a result of thermal effects, as a result of which the volatile hydrocarbon compounds of the bitumen, the formation of a denser coagulation structure of the bitumen, the reduction and embrittlement of the surface of the bituminous binder occur;

2) durability of bitumen-polymer materials depends on the nature and composition of the polymer (modifier). Bitumens modified with saturated polymers are resistant to atmospheric aging.

3) durability of polymer roofing materials is primarily determined by the chemical nature of the original polymer. The best are materials made on the basis of EPDM ("Krosil"). This material has undergone almost no changes in the process of natural, radiation-ozone and accelerated regimes: neither visual, nor physical, nor technical.

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